

Assessing chest pain accurately

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ON MONDAY MORNING, John, age 33, accompanied by his wife, comes into his primary care provider's office, complaining of chest pain. Two months ago, he had a treadmill test for cardiac disease, which was negative. His lab values at the time were normal, except for a positive *Helicobacter pylori* blood test. He was started on therapy to eradicate the bacteria; however, he returned this morning with similar chest pain symptoms as he's had in the past. He denies shortness of breath, palpitations, diaphoresis, or radiation of the pain. He describes the pain as similar to what he's previously had and stated that the medication he's taking for eradication of the bacteria in his stomach seemed to be helping; however, his pain today won't go away. Although his ECGs in the past were negative, his ECG today shows significant ST segment elevations in the inferior leads with corresponding reciprocal changes in the anterior leads. He's given supplemental oxygen, aspirin, and sublingual nitroglycerin, and put on continuous ECG monitoring. I.V. access is established. By the time the ambulance crew arrives, John's ECG changes and chest pain have resolved. He's taken to the local ED for evaluation and further cardiac workup.

What's wrong?

This case shows that clinicians must always evaluate each complaint of chest pain as if it were new. Additionally, patients who complain of chest pain won't always have the expected signs and symptoms.

According to the National Health Statistics Reports on Ambulatory Medical Care Utilization Estimates for 2006, 9 million patients had a complaint of chest pain and more than 2.5 million went to a primary care office for diagnosis and treatment. The data also revealed a decrease in the number of visits to ambulatory care settings for chest pain, from 0.9% in 2005 to 0.7% in 2006.¹

Although heart disease continues to be the leading cause of death in the United States for both men and women, death from cardiac causes has significantly decreased since 1980 in both sexes.² To maintain this downward trend in mortality, clinicians must continue to diagnose, manage, and treat chest pain appropriately.

Chest pain evaluation

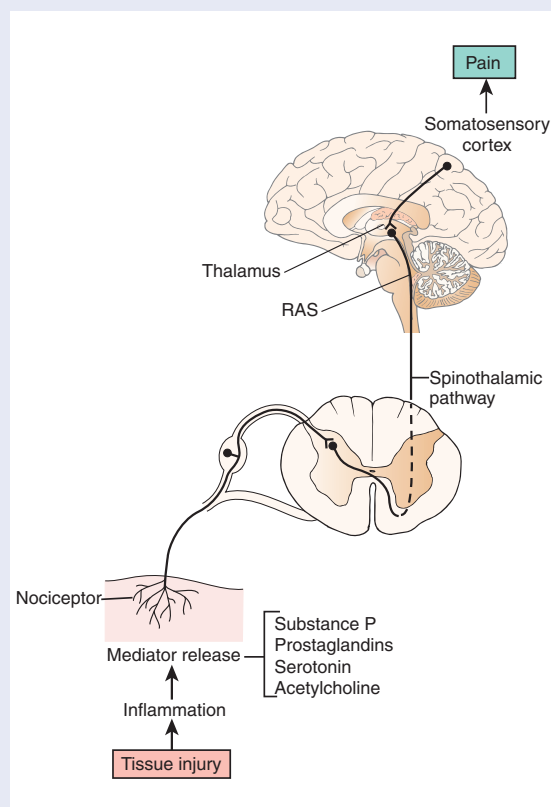
Understanding the physiology and the relationship between pain and its causes is important to differentiate what may be inducing the patient's pain.³⁻⁵ Pain in the chest region is mostly induced by mechanical, chemical, or thermal means and is considered to be nociceptive (see *Mechanism of acute pain*). Nociceptive pain arises from specific pain receptors and is classified as somatic or visceral in nature.

Visceral pain originates from specific internal organs, such as the heart, liver, bowels, or bladder. The pain receptors in the viscera react to stretch, inflammation, and ischemia. This type of pain is often described as an aching or heaviness, and is generalized to an area without localization. The decreased blood flow through an occluded or partially occluded coronary artery resulting in the sensation of heaviness or crushing-type feeling in the chest is an example of visceral pain.

Somatic pain, on the other hand, is described as sharp, piercing, and specific to a local area. Most patients can tell you the exact moment the pain began and point to the specific painful region. Somatic pain is reproducible. The clinician can reproduce the pain with palpation or the patient can cause the pain through movement.^{4,5} Costochondritis is an example of somatic pain.

Cardiac pain may have both a visceral and a somatic component or neither (silent myocardial infarction [MI]). Referred pain usually occurs because both the nerves (afferent fibers) of the viscera and the somatic

Mechanism of acute pain



Source: Porth CM, Matfin G. *Pathophysiology Concepts of Altered Health States*. 8th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins;2009:1235.

region enter the spinal cord at the same level.⁶ Thus, the patient who has both visceral and somatic pain could have a sharper and more localized sensation of the pain in the chest region. The patient with a silent MI may only experience symptoms of gastric fullness or a heaviness in the chest. This occurs due to a miscommunication to the brain regarding the pain experienced and often provides an additional challenge to the clinician evaluating the patient. However, asking pertinent questions regarding the type of pain the patient is experiencing, performing a thorough objective exam and obtaining the appropriate diagnostic tests will help lead to the correct diagnosis in the initial evaluation of a patient with chest pain.

Subjective history

You'll need to know the most common causes of chest pain as well as the distinguishing symptoms of both cardiac and noncardiac causes of chest pain (see *Clues in the*

patient's subjective history). Take a quick, but thorough subjective history. Most important, you and the patient must understand each other. Each patient brings his or her own past experiences of pain to the visit, as well as level of education, socioeconomic status, ethnicity, and individual pain threshold, which plays a role in how the patient will present and describe the current pain experience. Using follow-up questions, such as asking the patient to point to the area of pain, and repeating what the patient said can be very helpful in making sure the patient is understood.

Explore the characteristics of the chest pain first. These include quality, location, duration, intensity, accompanying symptoms, aggravating and alleviating factors, as well as the relationship between any type of exertion and pain experienced. Additionally, to help rule out an ischemic cause of chest pain, ask about any history (self or family) of angina or MI; the patient's age (coronary artery disease is more common with age); and additional risk factors, such as smoking, hypertension, hyperlipidemia, or diabetes. Gender also plays a role in chest pain complaints, as MIs are more common in men over the age of 40 and in women over the age of 50. Remember that chest pain in women may vary significantly from men. Women often have symptoms of fatigue, tiredness, or sleep disturbances as prodromal symptoms before a cardiac event.⁷⁻⁹

Physical assessment

You can ask the subjective questions above while performing a quick but thorough physical assessment. Although some physical findings are common for the various causes of chest pain, a patient with chest pain may not have all of these signs, and some patients may not have any signs at all (see *Chest pain physical assessment clues*). Determining the cause of chest pain depends on the patient's history and objective data from the physical exam and diagnostic tests.¹⁰ The most important diagnostic tool when evaluating chest pain is the ECG. The ECG may provide the most valuable clue to whether a patient is having an ischemic event; however, it should be noted that the ECG is limited with regard to its ability to fully evaluate the left ventricle's posterior, lateral, and apical walls.¹¹

Consider obtaining a posterior and/or right-sided ECG to evaluate further the patient's complaint; however, some research has shown that in low-risk patients, obtaining the additional ECGs wasn't effective.^{12,13}

Findings on a 12-lead ECG that are considered indicative of an acute MI include ST-segment elevation, Q waves, and possibly a conduction defect.¹⁴

Clues in the patient's subjective history⁶⁻¹⁴

Cardiovascular (ischemic)	Common pain description	Location/radiation	Possible associated symptoms
Angina: Stable (no change in pain pattern within last 60 days)	Pressure-like discomfort, for example, tightness, squeezing, burning, heaviness, which lasts 3-5 minutes precipitated by activity and often resolves with rest.	Generalized sub- or retrosternal: can radiate to teeth, jaw, neck, one or both arms or shoulders, or there may be no pain and only associated symptoms.	Diaphoresis, nausea, vomiting, dyspnea
Prinzmetal or variant angina	Pressure-like discomfort often occurring at rest and early morning hours.	Retrosternal: can radiate to jaw, neck, left arm, or shoulder.	Palpitations, syncope, or feelings of syncope
Acute coronary syndrome (unstable angina, myocardial infarction)	Heaviness, vise-like, squeezing, crushing, tightness, vague, burning, constricting, or pressure. Poorly localized pain lasting 20-30 minutes to hours and doesn't resolve with rest.	Generalized sub- or retrosternal: can radiate to teeth, jaw, neck, one or both arms or shoulders, or there may be no pain and only associated symptoms.	Indigestion-like feeling, nausea, vomiting, dizziness, flushing, perspiration, palpitations, dyspnea
Cardiovascular (nonischemic)			
Pericarditis	Sudden sharp and stabbing pain relieved by sitting or leaning forward. Pain worsens with lying down or inspiration.	Substernal, which can radiate to the trapezius muscle region	Dry cough, muscle, and joint aches, fever
Mitral valve prolapse	Sharp pain not associated with activity	Chest pain without radiation	Fatigue, lightheadedness, dyspnea, irregular heartbeat, palpitations, exercise intolerance
Aortic dissection	Sudden severe pain with change in location and/or tearing sensation lasting for hours	Anterior chest pain with radiation to the neck, jaw, or intrascapular region of back	Mental status changes, limb pain and weakness, dyspnea
Pulmonary hypertension (secondary)	Cardiac-like chest pain with exertion	Chest region	Dyspnea, lower extremity edema, fatigue.
Pulmonary			
Pulmonary embolism	Sharp, stabbing pain worsening with deep breaths	Pain can be experienced in chest, back, shoulder, or upper abdomen.	Dyspnea, hemoptysis, cough
Pneumonia	Sharp or stabbing pain associated with cough.	Mostly generalized to one side of chest, but can have upper abdominal pain.	Cough, fever, dyspnea, chills, sputum, myalgia, malaise
Pneumothorax	Acute/sudden and sharp	Lateral region of the chest, but can have referred pain to shoulder	Acute dyspnea, cough
Gastrointestinal			
Gastroesophageal reflux	May be angina-like; however, usually burning sensation with eating large meals reproduced with lying down and relieved with sitting up.	Retrosternal region	Cough, regurgitation of food, abdominal pain

(continued...)

Clues in the patient's subjective history^{6-14*} (continued...)

Gastrointestinal	Common pain description	Location/radiation	Possible associated symptoms
Esophageal spasm	Crushing chest pain	Substernal	Dysphagia, sensation of object in throat or esophagus
Cholecystitis	Sudden onset of pain that crescendos and can last for up to 20 minutes, usually after eating a fatty meal	Epigastrium or right upper abdomen that can radiate to right intrascapular region, shoulder, or back	Nausea, vomiting, anorexia, fever
Pancreatitis	Sudden dull, boring, steady pain unrelieved by lying supine; leaning forward or the fetal position may ease pain	Epigastrium or periumbilical pain radiating to back	Nausea, vomiting, anorexia, and sometimes diarrhea
Dermatological			
Herpes zoster	Unilateral, burning, borelike pain	Chest region in dermatome distribution	Tingling, itching, burning
Musculoskeletal / Neurological			
Costochondritis	Sharp, pleuritic-type pain worsens with deep breathing, palpation, or movement	Area from 2nd through 5th intercostal spaces. Can radiate to arm depending on where initial inflammation occurs.	Chest tightness, warmth at area of pain
Chest wall muscle strain	Sharp pain with moving, stretching, or pushing movements of the arms. Palpation of area reproduces the pain.	Area around the strained muscle, sternum, or ribs	Muscle spasm, crepitation, swelling, loss of strength
Psychogenic			
Depression	Heaviness	Chest region	Fatigue, restlessness, withdrawal, weight gain or loss, depressed mood
Anxiety	Sharp pain	Chest region	Palpitations, dizziness, sweating, shaking, restlessness, fatigue, irritability

* Most common are listed; however, some individuals have no symptoms during an acute or non-acute process.

In acute coronary syndrome, ST-segment elevation MIs have ST-segment elevations greater than 1 mm in two or more anatomically contiguous leads (anterior, inferior, or lateral) or may have a new-onset left bundle-branch block.¹⁵ Non-ST-segment elevation MIs may have an ST-segment depression, T-wave inversion, or appear normal initially. Obtain serial ECGs to evaluate for acute coronary syndrome.^{16,17}

Comparing the current ECG with a previous 12-lead ECG is very helpful in determining whether any changes indicate an acute event. Additionally, ST-segment eleva-

tions can be caused by other conditions that have no relationship to an MI, such as age, ethnicity, hyperkalemia, pericarditis, and myocarditis.^{18,19}

Red flags

Look for "red flags," or initial signs and symptoms that may indicate a life-threatening condition, including:

- abnormal vital signs (bradycardia, tachycardia, tachypnea, hyper- or hypotension)
- pallor, sweating, dyspnea, nausea, palpitations
- fever, chills, headache, malaise, productive cough

Chest pain physical assessment clues^{6-14*}

Chest pain cause	Possible physical exam clues
Acute coronary syndrome	Hypotension, bradycardia or tachycardia, low-grade fever, decreased oxygen saturation, S ₃ or S ₄ gallop, new-onset murmur or holosystolic murmur, bibasilar crackles, jugular venous distension, pale, diaphoretic, anxious appearing, xanthelasma or tendon xanthomata, absent foot pulses, bruits, skin changes, and hair loss may be seen.
Angina (stable)	No specific findings. Xanthelasma or tendon xanthomata, absent foot pulses, bruits, skin changes, hair loss.
Aortic dissection	Hypo- or hypertension, unequal pulses in arms, wide pulse pressure, dyspnea, aortic insufficiency murmur, muffled heart sounds, fever, altered mental status, decreased or absent pulses in lower extremities.
Anxiety	Restless mood, tachycardia, hyperventilation, systolic ejection click murmur, diaphoresis, flushing, muscle spasm.
Chest wall muscle strain	Muscle spasm, swelling, crepitation.
Cholecystitis	Positive Murphy sign (right upper quadrant tenderness to palpation).
Costochondritis	Reproducible pain at costochondral junctions.
Depression	Depressed mood; otherwise, usually noncontributory.
Esophageal spasm	Usually noncontributory.
Gastroesophageal reflux	Usually noncontributory; however, may have tenderness to palpation in the epigastric region.
Herpes zoster	Vesicular rash on erythematous base, distributed unilaterally along a specific dermatome.
Mitral valve prolapse	Mid-to-late systolic click, late systolic murmur at apex, mitral regurgitation, bradycardia, pectus excavatum, asthenic body habitus, scoliosis, blue sclera, arm span more than body height.
Pancreatitis	Hypotension, tachycardia, fever, Cullen sign (periumbilical ecchymosis), and Grey-Turner sign (ecchymosis in flanks).
Pericarditis	Pericardial friction rub (scratching or grating sound), with pericardial effusion and impending cardiac tamponade: Beck Triad (hypotension, jugular venous distension, and muffled heart sounds), tachypnea, tachycardia, fever, pulsus paradoxus of >10 mm Hg.
Pneumonia	<i>Bacterial:</i> Tachycardia or bradycardia, tachypnea, fever, cough, dark-colored, blood-tinged, or rusty sputum, decreased breath sounds, wheezes, crackles (rales), pleural friction rub, cyanosis, altered mental status, egophony. <i>Viral:</i> Tachycardia or bradycardia, tachypnea, fever, cough with or without purulent sputum, dyspnea, wheezing, crackles, decreased breath sounds, pleural friction rub, dullness to percussion, hypoxia. <i>Community Acquired:</i> Tachycardia, tachypnea, fever, crackles, tactile fremitus, bronchial breath sounds, egophony, dullness to percussion, purulent or blood-tinged sputum.
Pneumothorax	Tachycardia, tachypnea, hypoxia, asymmetry of respirations, diminished breath sounds on affected side, absent egophony on affected side, hyper-resonance to percussion, decreased fremitus, cyanosis.
Pulmonary hypertension (secondary)	Dyspnea, increased jugular venous pressure, accentuated pulmonic sound (P2), systolic ejection murmur, tricuspid regurgitation high-pitched systolic murmur, right ventricular S ₃ or S ₄ , right ventricular heave, hepatomegaly, ascites, lower extremity edema.
Pulmonary embolism	Hypotension, tachycardia, tachypnea, S ₃ or S ₄ gallop, murmur, pleural friction rub, wheezing, crackles, distended neck veins, fever, diaphoretic, lower extremity edema.

* Most common are listed, however, some individuals may have some or none of the signs above.

- wheezing, accessory muscle retractions
- pain intensified with inspiration
- asymmetric breath sounds
- decreased breath sounds
- absent breath sounds on one side
- asymmetric pulses (pulsus paradoxus over 10 mm Hg)
- new heart murmurs
- pericardial friction rub
- pain relieved by leaning forward
- increased pain by lying on the left side
- symptoms lasting more than 20 to 30 minutes.^{6-9,20-24}

Remember that two separate causes of chest pain can occur at the same time, as seen in the introductory case study. You must be able to quickly assess for any primary life-threatening conditions, and also evaluate for any secondary underlying cause that could have brought on the initial chest pain. Often, resolving the aggravating cause will decrease the acuity of the initial complaint or condition.

Remember to tell the patient what you're doing and keep the family members or significant others updated on the patient's condition.

Making the right call

When your patient has chest pain, you'll need to use your assessment skills to determine whether the patient is having an acute MI or some other life-threatening illness. By knowing the signs and symptoms of the various causes for chest pain, you can quickly assess and determine whether the patient has a life-threatening condition and provide appropriate and possibly lifesaving care. ■

References

- Schappert SM, Rechtsteiner EA. *Ambulatory Medical Care Utilization Estimates for 2006*. National health statistics reports; no 8. Hyattsville, MD: National Center for Health Statistics;2008.
- Heron MP, Tejada-Vera B. *Deaths: Leading Causes for 2005*. National vital statistics reports; vol 58 no 8. Hyattsville, MD: National Center for Health Statistics;2009.
- Eslick GD. Chest pain: a historical perspective. *Int J Cardiol*. 2001;77(1):5-11.
- Meldrum ML. A capsule history of pain management. *JAMA*. 2003;290(18):2470-2475.
- Ropper AH, Samuels MA. *Adams and Victor's Principles of Neurology*, 9th ed. New York: McGraw-Hill;2009.
- Cayley WE Jr. Diagnosing the cause of chest pain. *Am Fam Physician*. 2005;72(10):2012-2021.
- McSweeney JC, Crane PB. Challenging the rules: women's prodromal and acute symptoms of myocardial infarction. *Res Nurs Health*. 2000;23(2):135-146.
- McSweeney JC, Cody M, O'Sullivan P, Elbertson K, Moser DK, Garvin BJ. Women's early warning symptoms of acute myocardial infarction. *Circulation*. 2003;108(21):2619-2623.
- Eden BM. Chest pain in women: What's the difference? *Nurse Pract*. 2008;33(2):24-34.
- Allamsetty S, Seepana S, Griffith KE. 10 steps before you refer for: chest pain. *Br J Cardiol*. 2009;16(2):80-84.
- Gerwin RD. Myofascial and visceral pain syndromes: visceral-somatic pain representations. In: *Clinical Neurobiology of Fibromyalgia and Myofascial Pain*. 2002:165-175.
- Carter T, Ellis K. Right-ventricular infarction. *Crit Care Nurse*. 2005;25(2):52-54, 56-58, 60-62.
- Ganim RP, Lewis WR, Diercks DB, et al. Right precordial and posterior electrocardiographic leads do not increase detection of ischemia in low-risk patients presenting with chest pain. *Cardiology*. 2004;102(2):100-103.
- Zimetbaum PJ, Josephson ME. Use of the electrocardiogram in acute myocardial infarction. *N Engl J Med*. 2003;348(10):933-940.
- Kwa AT, Kao J, Amsterdam EA. Left bundle branch block and ST-elevation myocardial infarction: Sgarbossa revisited. *Crit Pathw Cardiol*. 2009;8(2):63-65.
- Kushner FG, Hand M, Smith SC, et al. 2009 Focused Updates: ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (updating the 2004 Guideline and 2007 Focused Update) and ACC/AHA/SCAI Guidelines on Percutaneous Coronary Intervention (updating the 2005 Guideline and 2007 Focused Update): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2009;120(22):2271-2306.
- Anderson JL, Adams CD, Antman EM, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 2002 guidelines for the management of patients with unstable angina/non-ST-elevation myocardial infarction): developed in collaboration with the American College of Emergency Physicians, the Society for Cardiovascular Angiography and Interventions, and the Society of Thoracic Surgeons: endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation and the Society for Academic Emergency Medicine. *Circulation*. 2007;116(7):e148-e304.
- Smalling RW, Giesler GM. Early and aggressive treatment of patients with acute ST segment elevation and non-ST segment elevation myocardial infarction leads to improved clinical outcomes. *Crit Pathw Cardiol*. 2004;3(3):121-127.
- Wang K, Asinger RW, Marriott HJ. ST-segment elevation in conditions other than acute myocardial infarction. *N Engl J Med*. 2003;349(22):2128-2135.
- Winters ME, Katzen SM. Identifying chest pain emergencies in the primary care setting. *Prim Care*. 2006;33(3):625-642.
- Institute for Clinical Systems Improvement (ICSI). *Diagnosis and Treatment of Chest Pain and Acute Coronary Syndrome (ACS)*. Bloomington, MN: Institute for Clinical Systems Improvement (ICSI); 2008.
- Finnish Medical Society Duodecim. Differential diagnosis of chest pain. In: *EBM Guidelines. Evidence-Based Medicine*. Helsinki, Finland: Wiley Interscience. John Wiley & Sons; 2008.
- Karnath B, Holden MD, Hussain N. Chest pain: differentiating cardiac from noncardiac causes. *Hospital Physician*. 2004;38:24-27.
- Erhardt L, Herlitz J, Bossaert L, et al. Task force on the management of chest pain. *Eur Heart J*. 2002;23(15):1153-1176.

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